

## CLAIMS

What is claimed is:

- 1           1.       A system for detecting underwater buried objects comprising:  
2           an acoustical camera adapted to produce three dimensional volumetric images of an  
3           underwater target area volume of an underwater floor;  
4           an acoustic transducer adapted to apply an acoustic pulse to the target area volume  
5           so as to cause displacement of materials included in the target area volume;  
6           and  
7           a controller adapted to coordinate operation of the camera and the acoustic  
8           transducer, wherein a first volumetric image of the target area volume is  
9           produced before the acoustic pulse is applied, and a second volumetric  
10          image of the target area volume is produced while the acoustic pulse is  
11          present in the target area volume.
- 1           2.       The system of claim 1 wherein the camera produces volumetric images of  
2          the underwater target area volume at a real-time frame rate.
- 1           3.       The system of claim 1 wherein the camera is further adapted to operate in  
2          an interferometer mode having a resolution of less than one wavelength.
- 1           4.       The system of claim 1 wherein the controller is further adapted to compare  
2          volumetric images for evidence of at least one of a partially or completely buried object.
- 1           5.       The system of claim 4 wherein the evidence of buried objects is based on  
2          movement of floor materials relative to the buried objects.
- 1           6.       The system of claim 1 further comprising:  
2           an image recorder adapted to record the volumetric images.
- 1           7.       The system of claim 1 wherein the acoustical transducer is extendible  
2          towards the target area volume.
- 1           8.       The system of claim 1 further comprising:

2 an image discrimination module adapted to discriminate interesting objects from  
3 non-interesting objects detected in the volumetric images.

1 9. The system of claim 1 further comprising:

2 a range finder adapted to detect when the system is at a proper distance from the  
3 target area volume for imaging purposes.

1 10. The system of claim 1 wherein the camera is configured for producing  
2 volumetric images within a 16 feet range at a frame rate greater than 10 frames/second, the  
3 camera having an acoustical lens configured for forming images on an array of acoustical  
4 transducer elements.

1 11. A system for detecting underwater buried objects comprising:

2 an acoustical camera adapted to produce three dimensional volumetric images of an  
3 underwater target area volume of an underwater floor;

4 an acoustic transducer adapted to apply an acoustic pulse to the target area volume  
5 so as to cause displacement of materials included in the target area volume;

6 and

7 a controller adapted to coordinate operation of the camera and the acoustic  
8 transducer, so that a volumetric image of the target area volume is produced  
9 while the acoustic pulse is present in the target area volume, thereby  
10 allowing buried objects to be detected based on relative movements in the  
11 target volume area.

1 12. The system of claim 11 wherein the camera is further adapted to operate as  
2 an acoustical imaging interferometer having a resolution of less than one wavelength.

1 13. A method for detecting underwater buried objects comprising:

2 producing one or more three dimensional volumetric images of an underwater  
3 target area volume of an underwater floor;

4 applying an acoustic pulse to the target area volume so as to cause displacement of  
5 materials included in the target area volume; and

6           producing one or more second volumetric images of the target area volume while  
7           the acoustic pulse is present in the target area volume.

1           14.    The method of claim 13 wherein producing volumetric images of the  
2   underwater target area volume is performed at a real-time frame rate.

1           15.    The method of claim 13 wherein producing volumetric images of the  
2   underwater target area volume is performed using a resolution of less than one wavelength.

1           16.    The method of claim 13, further comprising:  
2           comparing volumetric images for evidence of at least one of a partially or  
3           completely buried object.

1           17.    The method of claim 16 wherein comparing volumetric images for evidence  
2   of buried objects includes detecting movement of floor materials relative to the buried  
3   objects.

1           18.    The method of claim 13 further comprising:  
2           recording the volumetric images.

1           19.    The method of claim 13 further comprising:  
2           discriminating interesting objects from non-interesting objects detected in the  
3           volumetric images.

1           20.    The method of claim 13 further comprising:  
2           detecting a proper distance from the target area volume for imaging purposes.